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Impact of Small Raindrops on Crude Oil Slicks[1] DAVID MORRA, NOURAH ALMASHAN, DAVID MURPHY, JOSEPH KATZ, Johns Hopkins University Department of Mechanical Engineering — The impact of millimeter size water droplets falling near terminal velocity (e.g. rainfall) on a pool is known to produce air bubbles at the bottom of the splash cavity. These bubbles produce noise and contribute to marine aerosol production. Layers of crude oil resulting from oil spills alter air-sea interfacial properties. Our high speed observations examine the effect of oil layer thickness on the entrainment of air and oil as small raindrops impact the surface. They reveal that layers in the 10-400 μm range suppress bubble entrainment, likely due to the reduction of air-liquid surface tension (from 72 to 28 mN/m). For "low energy" impacts (droplets <2 mm and speed <2.5 m/s) and <200 μm layers, rupture of the film in less than 1 ms causes rapid retraction of the oil layer across the subsurface cavity and formation of oil droplets on the cavity side. Subsequently, as the cavity collapses, a vortex ring develops at the bottom of this cavity and forces these droplets downward. Impact on thicker oil layers results initially in accumulation of the drop fluid at the cavity base. When the drop subsequently penetrates the layer, it creates multiphase vesicles, i.e. drops of freshwater coated by a thin oil film, which migrate down into the bulk seawater.

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